Sensing the presence of moisture in soils…

Soil Moisture Probe

The Soil Moisture Probe indicates the presence of moisture in soils. It is one of several probes at the INEEL inserted directly into disposed wastes to monitor subsurface conditions that impact contaminant migration. The data this probe provides, combined with other probe data, can significantly influence environmental investigations and impact cleanup decisions.

The Soil Moisture Probe contains a sensor that uses electrical impulses to accurately measure soil moisture content.

Why the need for this probe

The INEEL Environmental Restoration Program needed to measure the amount of moisture in the soil surrounding buried waste and track seasonal changes in the moisture content.

What the probe does

The Soil Moisture Probe measures soil moisture content, soil resistivity and temperature to provide long-term monitoring of moisture within a waste zone. It indirectly measures the moisture content of soil using the relationship between the soil dielectric constant and the moisture content.

The soil moisture content is determined by measuring the shift of a high-frequency signal as it passes through the soil. The probe performs resistivity surveys of the profile to measure electrical contrasts between different geologic features. It also surveys changes in resistivity.

Probe and operation description

The Soil Moisture Probe purchased and used at the INEEL incorporates features to meet INEEL's needs. For example, The probe is sealed to eliminate the potential pathway for contaminants to reach the land surface.

The soil moisture sensor housed inside the body of the probe is located behind the probe's conical tip. It is here that soil moisture electrodes are embedded into the probe's construction. It can be driven underground until it hits a point of refusal.

This technology is commercially available through Applied Research Associates (ARA)/VERTEK.

In some cases, up to three moisture sensors can be stacked in a single probe string to determine soil moisture at different depths. In other cases, single sensors can be used in multiple, co-located probe strings for the same purpose. The depth of each moisture sensor is planned and installed in the probe string prior to insertion into the ground. The sensors are generally placed as close as possible to the vertical horizons being studied. Typical vertical horizons include:

- Overburden and waste interface
- Middle of waste zone
- Waste and underburden interface.

The Soil Moisture Probe is connected to a data logger where measurements are stored and periodically downloaded.

A technician makes final connections to the Soil Moisture Probe, seen here with its rings of conductivity and resistivity.

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Data results

The data collected include soil moisture volumetric—expressed in percent, resistivity—expressed as ohm-m, and temperature—expressed in degrees Celsius. When these data are factored in with data obtained from the Tensiometer Type B probe, for example, the calculation of moisture flux through the waste zone can be determined. Moisture flux is an important parameter in determining contaminant migration.

Data collected by the probe is transmitted to this data logger, which in turn sends the data via radio frequency to a remote computer station.

Benefits

Subsurface data obtained as a result of using the Soil Moisture Probe includes the following benefits:

- Quantifies water infiltration and potential movement of contaminants
- Increases understanding of how moisture flux influences the rate contaminants are released from waste and transported to the subsurface
- Reduces uncertainty in risk assessment calculations that influence decisions to protect people and the environment
- Increases worker safety and reduces exposure to contaminated samples
- Avoids environmental harm by not displacing contaminated soil
- Validates the accuracy of characterization data, process knowledge and suspected hot spot locations.

Points of contact

To discuss how the Soil Moisture Probe might apply to your needs, contact *Andy Baumer*, or one of the other references at the phone or e-mail address shown. The INEEL's *Technology Catalog* is another reference on new and innovative technologies. It's on the web at *tech.inel.gov*.

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